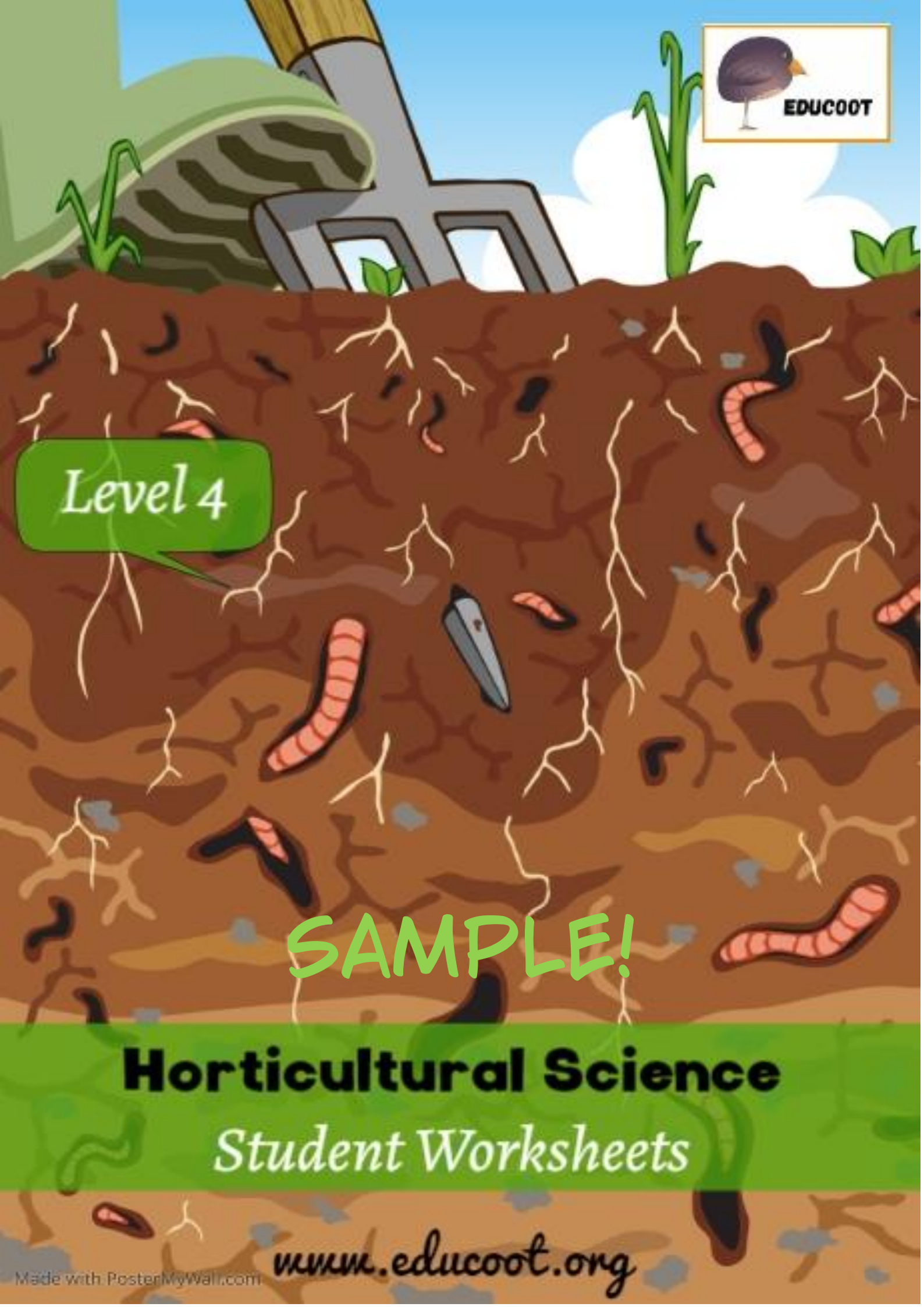
EDUCOOT
Level 4
SAMPLE!
Horticultural Science
Student Worksheets
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Contents

Note to Students
Background Information
PLANT PHYSIOLOGY AND GROWING MEDIA
A. Main Parts of a Plant & Their Functions
B. Flowers
C. Seeds
D. Roots
E. Leaves
F. Stems
G. Monocots and Dicots
H. Photosynthesis
I. Respiration
J. The Function and Use of Fertilisers
K. Growing Media
L. Making Compost
M. Evaluation
Checklist
PROPAGATION METHODS
A. Dormancy
B. Treatments to Overcome Seed Dormancy
C. Requirements for Seed Germination
D. Taking Care of Seedlings
E. Plant Propagation
F. Other Methods of Propagation
G. Artificial Methods of Plant Propagation
H. Propagating a Cutting
I. Hydroponics
J. Garden Pests
Checklist
SOIL FORMATION, COMPOSITION AND FERTILITY
A. Soil
B. Weathering Agents in the Formation of Soil
C. Living and Non-living Parts of Soil
D. Characteristics of a Fertile Soil
E. Good Soil Management
F. Irish Soils
Checklist
HORTICULTURE & THE ENVIRONMENT
A. Horticulture and the Environment
B. Biodiversity
C. Ecosystem Gardening
Checklist
GARDEN TOOLS & EQUIPMENT
A. Everyday Garden Tools
B. Gardening Safety
Checklist
GARDEN PROJECT
A. About the Project
B. Planning the Gardening Tasks
C. Getting Ready to Plant
D. Maintaining your Garden
Mapping of Learning Outcomes

A. Main Parts of a Plant & Their Functions

1. Read: The basic parts of most land plants are roots, stems, leaves, flowers, fruits, and seeds.

Roots anchor the plants in the soil and absorb nutrients and water that are needed by the rest of the plant.

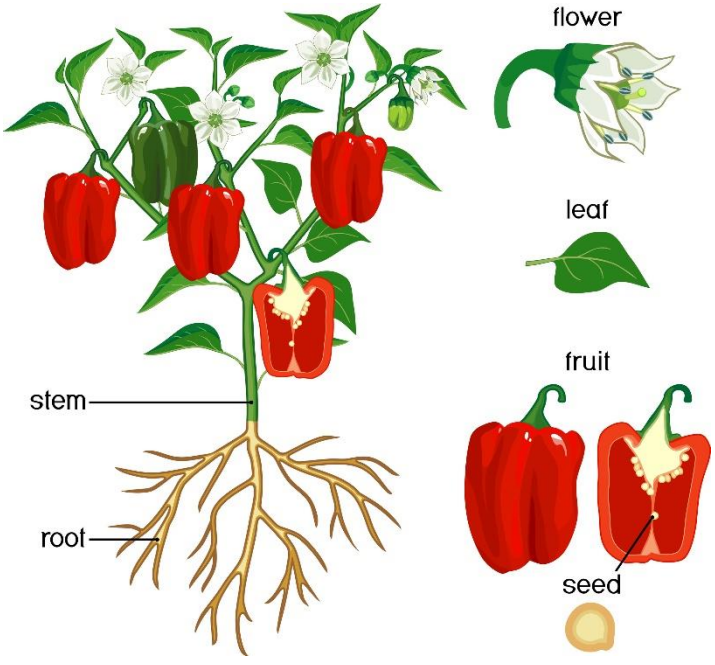
Stems support the upper part of the plant and act as a transport system for nutrients, water, sugar, and starches. Photosynthesis can occur in the stem of some plants such as: cacti, celery, asparagus, and bananas.

Leaves are the parts of the plant where photosynthesis usually occurs–where food for the plant is made. The green substance, chlorophyll, captures light energy and uses it to convert water and carbon dioxide into plant food and oxygen.

Flowers are the reproductive part of plants. They often have showy petals and fragrances to attract pollinators such as birds, bees, and other insects.

Fruits are the fleshy substances that usually surround seeds. They protect the seeds and attract animals to eat them. This helps in seed dispersal.

Seeds contain plant material that can develop into another plant. This plant material is called an embryo. Seeds are covered with a protective seed coat and have one or two cotyledons. Cotyledons are the food for the baby plant until it can make its own food from light and are often the first embryonic leaves of the plant.



2. Complete the sentences:

chlorophyll, seeds, water, Flowers, photosynthesis, anchor

Roots _____ plants in the soil and absorb nutrients and water.

Stems support the upper part of the plant and act as a transport system for nutrients, _____ ,sugar, and starches.

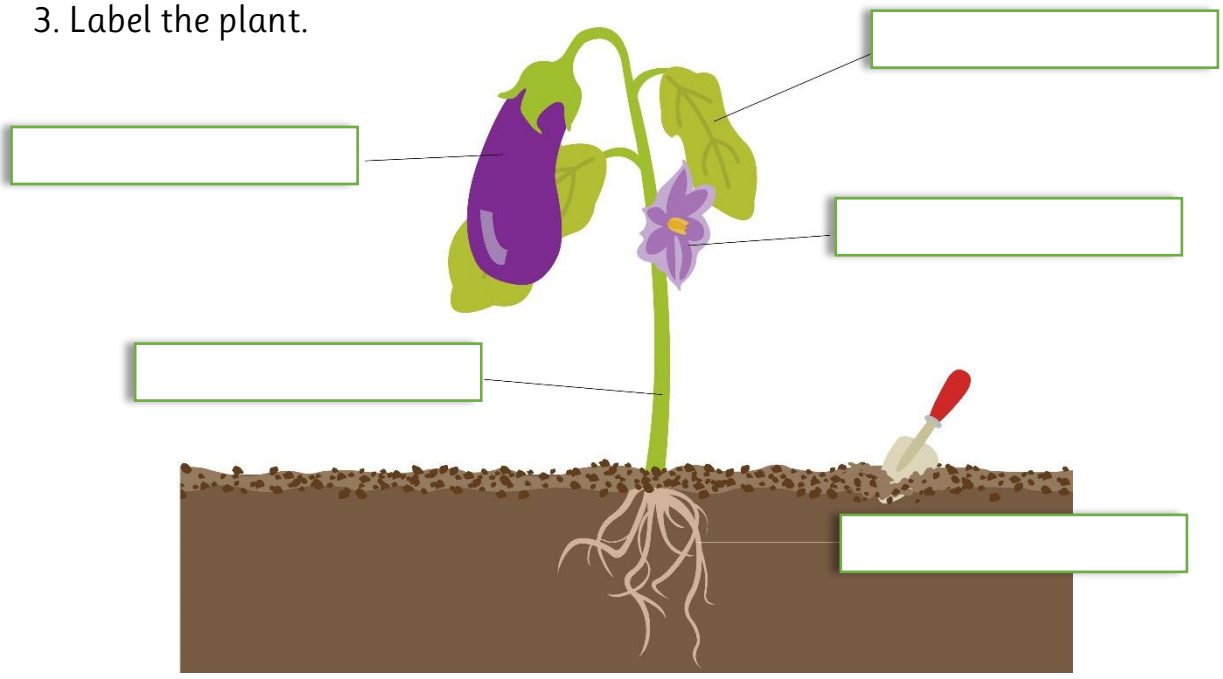
Leaves are the parts of the plant where _____ usually occurs–where food for the plant is made.

The green substance, _____ , captures light energy and uses it to convert water and carbon dioxide into plant food and oxygen.

_____ are the reproductive part of plants.

Fruits are the fleshy substances that usually surround _____ .

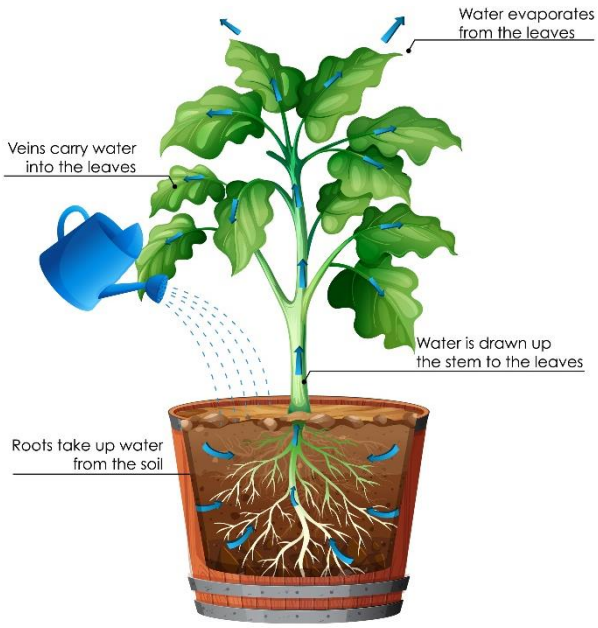
3. Label the plant.



6. Follow the instructions.

EXPERIMENT: HOW PLANTS ABSORB WATER

Carry out this experiment and fill in the experiment report over the page.



Title: How plants absorb water

What you need:

- Cabbage (this also works with flowers or celery!)
- Food Colouring
- Jars
- Water

Instructions:

A. Add water to each jar, filling about half way.
B. Add a different colour food dye to each jar, adding enough so the colour is vibrant.
C. Add separate cabbage leaves or flowers to each jar, with the stalk/stem submerged under the water.
D. Leave your cabbage leaves or flowers overnight.
E. Check on your experiment the following day. What do you observe?

Notice how the colours of the flowers are the same as the food colouring!

Hint: Plants have tiny tubes that help carry water up through the stem, and to the leaves. The water molecules are attracted to the molecules in the tubes, helping to pull the water upward. You should see these pathways with your experiment!

Science Experiment

Title: _____

Date: _____

1 PURPOSE

4 RESULTS

2 MATERIALS

5 CONCLUSION

3 PROCEDURE

6 YOUR COMMENT/S

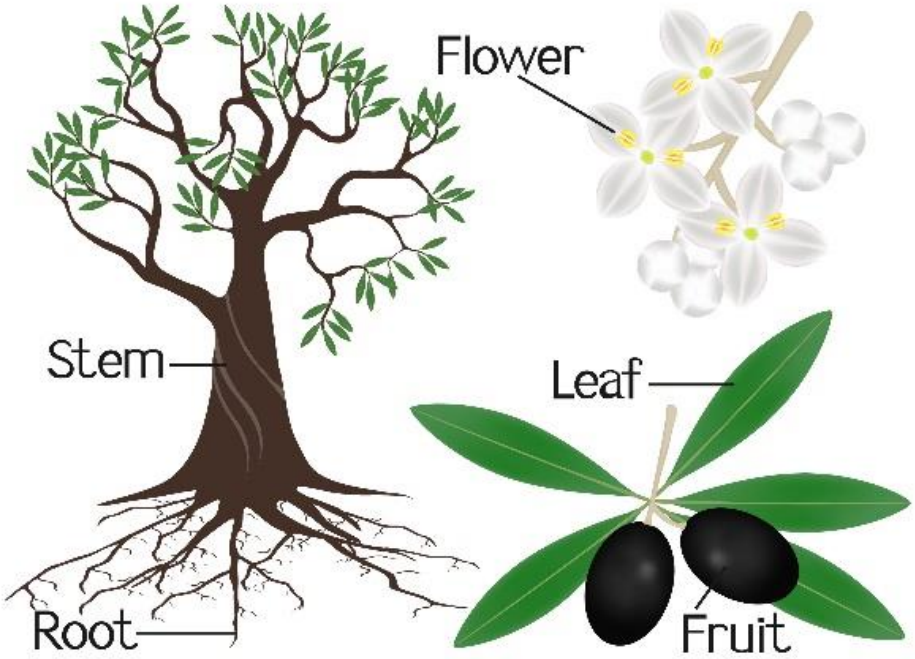
Rate the success of your experiment.

9. Name 3 functions of roots.

10. Name the 2 types of roots.

11. What happens to the root if the soil is packed too tightly?

12. What kind of root does this tree have?



13. Name 5 root vegetables.

14. Tick the roots that you like to eat.



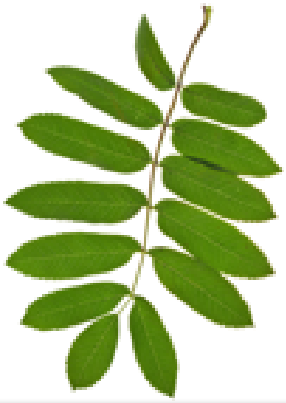







7. Label these leaves below:

Raspberry, Rowan, Oak, Willow, Birch, Fern



4. Follow the instructions.

EXPERIMENT: SEEING PHOTOSYNTHESIS

Carry out this experiment and fill in the experiment report over the page.

Title: Seeing photosynthesis take place

What you need:

- Glass bowl/Large beaker
- Water (lukewarm)
- New-picked leaf
- Small rock
- Magnifying glass

Instructions:

A. Fill a large, glass bowl with lukewarm water. (a glass bowl is better as you'll be able to see the experiment from all angles, a large beaker could also be used)
B. Go outside and find a large leaf. You'll want to remove a leaf from a tree or plant and not just pick one up off the ground as you need an 'active' leaf for the experiment.
C. Place the leaf in the bowl of water and put a small rock on top of it so it is FULLY submerged under the water.
D. Put the bowl in a sunny spot. (outside if suitable)
E. Now wait! Take a peek a few hours later. Use a magnifying glass to get a closer look.

Hint: What you should have seen were small bubbles that formed around the leaf and the edges of the bowl. The leaf was still using the sunlight as part of the photosynthesis process (where leaves convert sunlight to energy). As a leaf creates that energy, it needs to get rid of the items it no longer needs so it will expel both the extra oxygen during photosynthesis along with water (the release of water from a plant is called transpiration).

The process of photosynthesis is what allows you to see the bubbles - as the leaf releases its extra oxygen while submerged, the oxygen can be seen as bubbles in the water.

And since oxygen is lighter than water, the bubbles will eventually rise to the surface.

Science Experiment

Title: _____

Date: _____

1 PURPOSE

2 MATERIALS

3 PROCEDURE

4 RESULTS

5 CONCLUSION

6 YOUR COMMENT/S

Rate the success of your experiment.

I. Respiration

1. Read: Plant cells respire, just like animal cells do. If they stop respiring, they will die. Respiration is not the same as breathing - plants do not breathe.

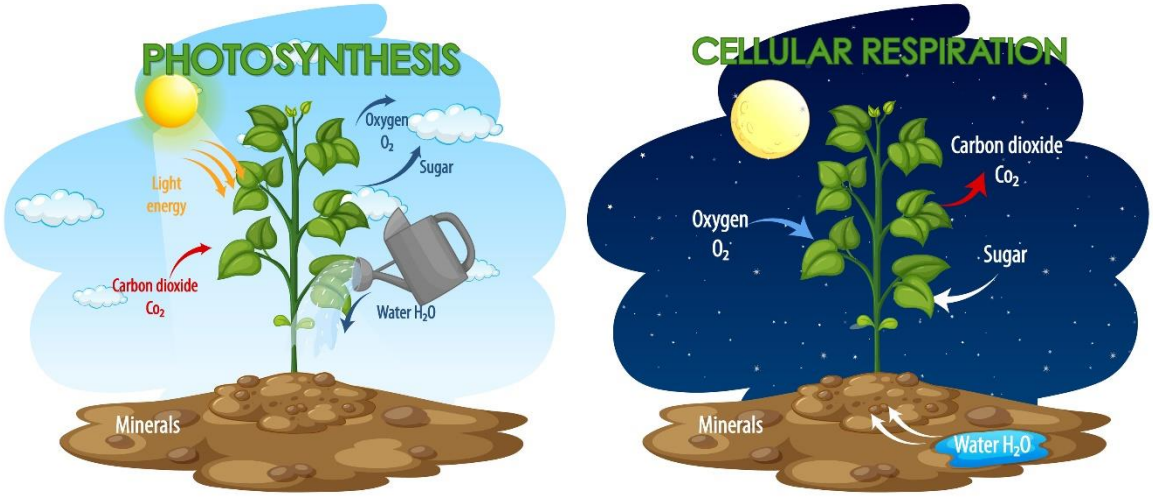
Here is the word equation for aerobic respiration:

glucose + oxygen → carbon dioxide + water

Here is the word equation for photosynthesis:

carbon dioxide + water → glucose + oxygen

- Aerobic respiration uses oxygen and produces carbon dioxide.
- Photosynthesis uses carbon dioxide and produces oxygen.



Plants respire all the time, whether it is dark or light. They photosynthesise only when they are in the light.

Conditions	Photosynthesis v respiration	Overall result
Dark	Respiration but no photosynthesis	Oxygen taken in, carbon dioxide given out
Dim light	Photosynthesis rate equals respiration rate	Neither gas is taken in or given
Bright light	Photosynthesis rate greater than respiration rate	Carbon dioxide taken in, oxygen given out

K. Growing Media

WHAT IS A GROWING MEDIUM?

1. Read: The term 'growing medium' is used to describe the material used in a container to grow a plant.

There are many different ingredients that can be used to make a growing medium; different parts of the world have developed media based on local availability of various raw materials.

Such materials can be inorganic (e.g. rockwool, perlite) or organic (e.g. peat, bark). Growing media are often formulated from a blend of different raw materials in order to achieve the correct balance of air and water holding capacity for the plants to be grown.

The requirements of a growing medium:

- To provide anchorage for the plant
- To provide adequate air spaces for root respiration
- To hold sufficient available water
- To hold sufficient available nutrients
- To be free of plant pathogens, pests and weeds
- To be safe when handled by people

Manufacturers also need growing media to be physically and chemically stable from the time of production until the time of use (this can be many months for retail products). The weight of the ingredients used is also important because this affects transport costs, a major part of the total cost of production and delivery to the end customer.

Planting an orchard with pine bark

3. Read:

WHY COMPOSTING IS GOOD

Compost is the single most important supplement you can give your garden. It's a simple way to add nutrient-rich humus to your lawn or garden that encourages plant growth and restores vitality to depleted soil. It's also free, easy to make, and good for the environment.

Soil conditioner

With compost, you are creating rich humus for your lawn and garden. This adds nutrients to your plants and helps retain soil moisture. It is called "black gold" for obvious reasons!

Recycles kitchen and garden waste

Composting can save as much as 30% of household waste. When organic matter hits the landfill, it lacks the air it needs to decompose quickly. Instead, it creates harmful methane gas as it breaks down, which increases the rate of global warming and climate change.

Introduces beneficial organisms to the soil

Microscopic organisms in compost help aerate the soil, break down organic materials for plant use, and keep away plant disease.

Good for the environment

Composting offers a natural alternative to chemical fertilisers when applied to lawns and garden beds.

Reduces landfill waste

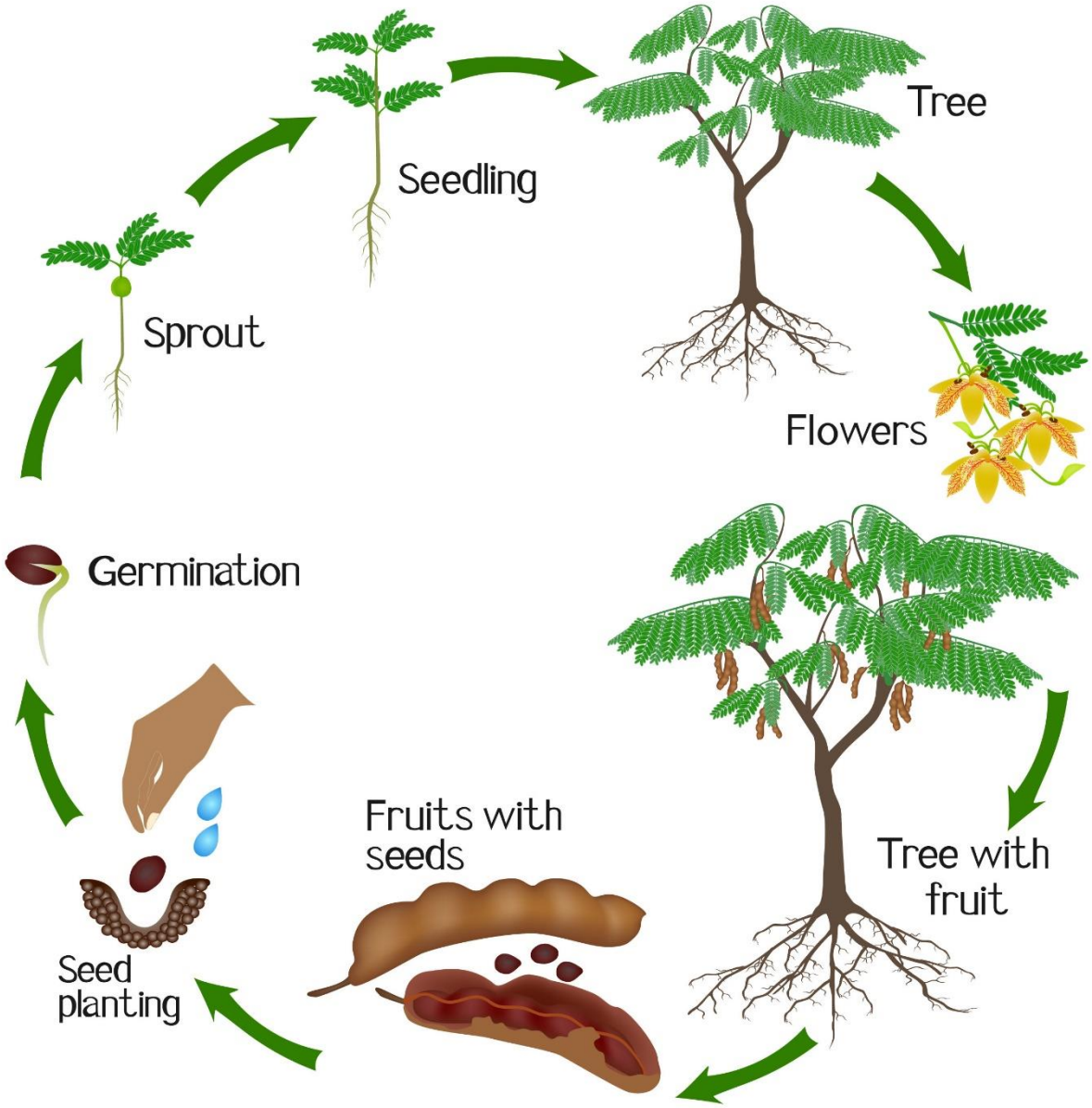
Most landfills are quickly filling up. One-third of landfill waste is made up of compostable materials. Reducing this waste from the landfill means that our landfills will last longer, and so will our wild spaces.

4. Give 5 ways in which composting is good for the environment.

5. Investigate the cost of a compost bin. Search online and write the information below. Include the name of it, where you can purchase it, the cost and why you chose it.

A. Taking Care of Seedlings

1. Describe the cycle of the plant below from when it's a seed.



2. Read:

THIN YOUR SEEDLINGS AS NEEDED

Plants in your garden do not like to be crowded. It's the same with your seedlings, who need all the sun and nutrients that they can get. You may want to leave a few extras for a while as the mortality rate of seedlings can be high.

GIVE THEM PLENTY OF LIGHT

As soon as the new seedling begins to emerge, it seeks light. It needs as much and as direct a light source as possible. Placing it by a window with a southern exposure is the first step. But this might not be enough for the seedling to grow healthy and strong. For extra light, you could get an artificial light and place the seedlings under it on cloudy days and at night.

4. Grow different plants from seeds. Fill in the template below. Include evidence of your gardening activities and the growth of your seeds.

Date planted	Seed variety	No. of containers	No. of seeds planted
Seed company	Expiry date	Date of first seedlings	Number of seedlings
Date of full germination	Number of seedlings total	Transplant to garden date	Comment

*Grow the seeds! Print and use this page for each type of seed.

Slugs and Snails

Slugs and snails are a common pest and can cause much damage. At night time they feed on most crops; damaging foliage, roots, stems and bulbs before retreating out of sight during the day. They are hermaphroditic (having both male and female reproductive organs) and they lay their eggs only a few days after reproduction. They lay an average of about thirty eggs and these can lay dormant in the soil for years.

Things you can do:


Relocating slugs!

- Remove them by hand - this can be time-consuming, but at least you are not causing any harm.
- Use ground covers as a natural snail repellent. Slugs and snails have a harder time getting to your plants if they are surrounded by ground covers that are not easy to slide over. So, if you add a layer of wood chips, gravel, or bark to your garden beds, this will help repel snails and slugs naturally.
- Keep snails out by watering early in the morning. Snails are mostly out at night, and they have more difficulty getting around on dry soil than they do on moist soil. So, if you do your watering early in the morning, this gives the top layer of soil more time to dry out before nightfall, which makes it more difficult for snails and slugs to get to your plants.
- Use copper as an effective slug and snail repellent. When snails touch copper, their slime reacts in a way that they get an uncomfortable electrical shock that will encourage them to turn around and go elsewhere! Adhesive copper tape is available at hardware shops, garden centres, or online. If you use adhesive copper tape, you can run the tape along the edges of your garden beds to keep snails from entering.
- You can also use copper coins to protect your garden. When using these, you can glue them to your garden bed to keep them in place and make sure they are very close together so you do not leave paths for smaller snails and slugs to get through.
- Deter snails and slugs with sacrificial plants or trap plants. This attracts the pests elsewhere, e.g. you can plant some lettuce away from your prized plants. Snails like the taste of lettuces better than most plants, so they will more likely munch on your lettuce leaves than your precious plants.
- Lavender, sage, rosemary, parsley, creeping thyme, and mint are all nice additions to an herb garden that also happen to deter snails.

- Plant marigolds. Snails are actually attracted to marigolds, so if snails are your problem, you will need to plant your marigolds away from your garden, rather than near it.

Slugs munching!

Choose one organic method to deter snails and slugs. Write the instructions.

Method:

Instructions:

C. Living and Non-living Parts of Soil

1. Read:

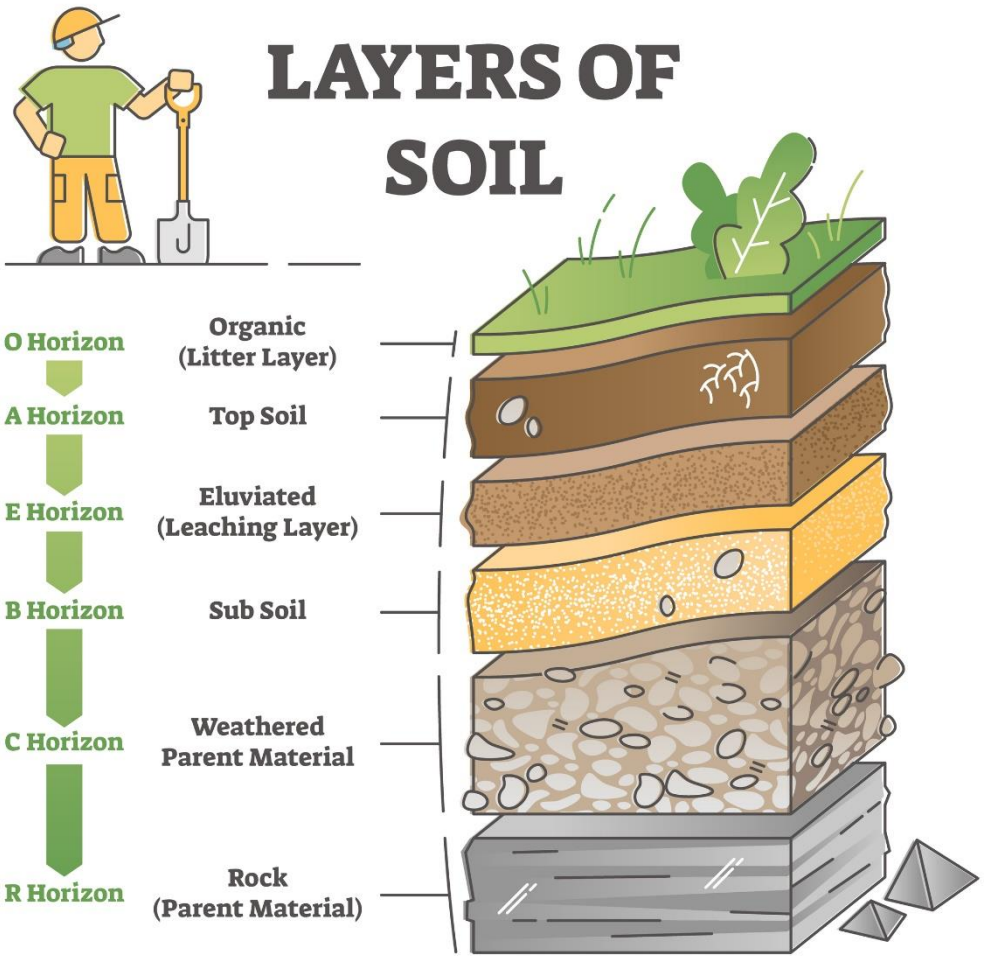
SOIL LIFE

All soil is made up of inorganic mineral particles, organic matter (including living things), air and water.

Inorganic mineral particles make up more than half the volume of soil. These particles come from rocks – the parent material that formed the soil. Soil mineral particles are sorted into three groups based on their size:

- Sand
- Silt
- Clay

Sand particles are the biggest and clay particles are the smallest. If you rub soil between your fingers, the sand particles make it feel gritty. Silt soils feel smooth and floury. A slick or sticky feel comes from clay.



A. Horticulture & the Environment

1. Read: Sustainable agriculture is defined as "the productive, competitive and efficient production of safe agricultural products, while protecting and improving the natural environment and the socio-economic conditions of farmers and local communities."

So, sustainability is about making sure that, not only do we farm efficiently but, we pass the land on to the next generation in as good or even better condition than when we inherited it.

2. See the Bord Bia website:

https://www.farmingfornature.ie/resources/

3. Find an article about how the environment is looked after by farmers. Write about it.

4. Prepare a presentation on protection of the environment during horticultural practice.

Garden Project

In this section, you will be expected to:

1. Identify plant parts to include roots, stems, buds, leaves, flowers, fruit and seed
2. Show an understanding of these processes while planting and maintaining your garden - seed germination, photosynthesis, respiration, water and mineral movement, pollination and seed dispersal.
3. Use your knowledge of soil and the major and minor nutrients required for plant growth.
4. Understand how climate and weather can affect horticultural production and use this knowledge to grow healthy plants.
5. Encourage biodiversity in your garden.
6. Carry out all gardening tasks to include garden planning, identifying requirements, planting seeds, maintaining plants, harvesting, etc.
7. Calculate amounts, areas, rates and volumes for basic horticultural tasks including estimating quantities of materials required, plant spacing and area measurement.
8. Work as a team to accomplish the gardening goals.

<u>It will be preferable if this project is completed as a team.</u>

Mapping of Learning Outcomes

1 Identify plant parts to include roots, stems, buds, leaves, flowers, fruit and seed Pages 10 to 14 (main parts of a plant and their functions), Pages 15 to 20 (flowers), Pages 21 to 28 (seeds, fruit), Pages 29 to 33 (roots), Pages 34 to 39 (leaves), Pages 40 to 41 (stems), Pages 42 to 45 (monocots and dicots), Pages 46 to 61 (photosynthesis), Pages 62 to 63 (respiration)

2 State the functions of roots, stems, buds, leaves, flowers, fruit and seed Pages 10 to 14 (main parts of a plant and their functions), Pages 15 to 20 (flowers), Pages 21 to 28 (seeds, fruit), Pages 29 to 33 (roots), Pages 34 to 39 (leaves), Pages 40 to 41 (stems), Pages 42 to 45 (monocots and dicots), Pages 46 to 61 (photosynthesis), Pages 62 to 63 (respiration)

3 Describe basic living processes of plants to include seed germination, photosynthesis, respiration, water and mineral movement, pollination and seed dispersal Pages 21 to 28 (seeds, fruit), Pages 34 to 39 (leaves), Pages 40 to 41 (stems), Pages 46 to 61 (photosynthesis), Pages 62 to 63 (respiration), production Pages 92 to 93 (seed dormancy), Pages 99 to 105 (requirements for seed germination), Pages 106 to 112 (taking care of seedlings), Pages 113 to 117 (plant propagation), Pages 118 to 119 (artificial methods of plant propagation), Pages 120 to 124 (propagating a cutting)

4 Describe soil properties to include formation, composition, texture and structure Pages 64 to 70 (function and use of fertilisers, 14 important elements for healthy growth), Pages 71 to 78 (growing media), Pages 79 to 87 (making compost), Page 88 (evaluation of growing media), Page 138 (soil), Pages 139 to 146 (weathering agents in formation of soil), Pages 147 to 157 (living and non-living parts of soil), Pages 158 to 160 (characteristics of a fertile soil), Pages 161 to 164 (good soil management), Pages 165 to 168 (Irish soils)

5 Outline the movement of water, nutrients and air in soil Pages 10 to 14 (main parts of a plant and their functions), Pages 15 to 20 (flowers), Pages 21 to 28 (seeds, fruit), Pages 29 to 33 (roots), Pages 34 to 39 (leaves), Pages 40 to 41 (stems), throughout study of plant parts and their functions

6 State major and minor nutrients required for plant growth Pages 64 to 70 (function and use of fertilisers, 14 important elements for healthy growth), Pages 79 to 87 (making compost), Pages 158 to 160 (characteristics of a fertile soil)

7 Outline the main elements of climate and weather and how they affect horticultural production Pages 92 to 93 (seed dormancy), Pages 94 to 98 (treatments to overcome seed dormancy), Pages 99 to 105 (requirements for seed germination)

8 State the role of environmental protection, ecosystems and biodiversity in sustainable horticultural practice Pages 79 to 87 (making compost), Pages 106 to 112 (taking care of seedlings), Pages 113 to 117 (plant propagation), Pages 118 to 119 (artificial methods of plant propagation), Pages 120 to 124 (propagating a cutting), Pages 125 to 127 (hydroponics), Pages 128 to 134 (garden pests), Pages 161 to 164 (good soil management), Pages 171 to 173 (horticulture and the environment), Pages 174 to 175 (biodiversity), Pages 176 to 179 (ecosystem gardening)

9 Calculate amounts, areas, rates and volumes for basic horticultural tasks including estimating quantities of materials required, plant spacing and area measurement. Pages 79 to 87 (making compost), Pages 200 to 213 (garden project), THROUGHOUT THE COURSE for all gardening activities

EXTRA:

Pages 182 to 187 (everyday garden tools), Pages 188 to 198 (gardening safety)